Mathematics and Science Partnerships Program Highlights

Analytic and Technical Support for Mathematics and Science Partnerships

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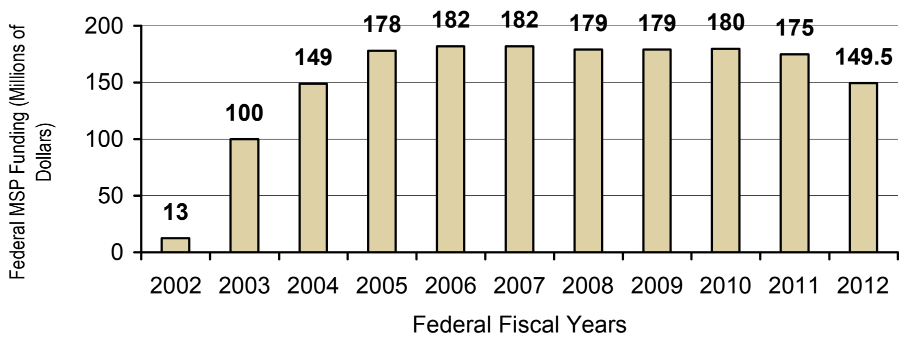
Mathematics and Science Partnerships Program Overview

The Mathematics and Science Partnerships (MSP) Program came into being in 2002 as a part of the passage of the *No Child Left Behind Act of 2001.* The MSP Program administered at the U.S. Department of Education is designed to improve the mathematics and science knowledge of classroom teachers while encouraging them to increase their use of teaching techniques associated with improved student learning. One unique aspect of this program is that it requires projects to be conducted through local partnerships between high-need school districts and science, technology, engineering and/or mathematics (STEM) departments in colleges and universities. Projects reporting in the three most recent fiscal years (2006–2009) had an average of 10 partner organizations per project.

The U.S. Department of Education's MSP Program has been administered as a formula grant program to the states since 2003. The amount of money given to individual states is based on the size of the student population and poverty rates within that state. Each state then issues a request for proposals, specifying priorities for projects and inviting educational institutions to apply for sub-grants. All 50 states, the District of Columbia, and Puerto Rico have received MSP formula grants. Exhibit 1 shows the funding disbursed by the U.S. Department of Education between 2002 and 2012.

Exhibit 1: MSP Program Funding, Fiscal Years 2002–2012



Source: U.S. Department of Education state budget tables.

A substantial number of educators and students have received the benefits of improved science and mathematics instruction, relative to the size of this investment. Since 2004, an average of 52,000 educators have annually received professional development services in mathematics and science through this program—a total of approximately 310,000 participants. In the last three years, educators have reached approximately 2.6 million students annually, or over 7.8 million students in total. Many MSP projects train instructional leaders, who then provide training to other teachers in their schools and districts, further expanding the professional development reach. Most of the teachers who participate in MSP projects are regular classroom teachers responsible for mathematics or science content, though principals and district personnel also participate in some projects. In the early years of the MSP Program more projects served middle school educators, but in the last three years there has been a shift towards elementary grade educators. The next section will explore the alignment between MSP project components and research-based best practices.

Research on Effective Professional Development

A number of research studies have identified components of in-service teacher professional development (PD) programs that have an effect on practice and student learning. The first component is the substantial time that needs to be invested in the PD experience for it to have an effect on practice and ultimately student learning. A review (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007) of research studies with rigorous evaluation designs found that teachers who received an average of 49 hours of PD, spread over 6 to 12 months, boosted their students' achievement by about 21 percentile points on standardized achievement tests. PD that offered 5 to 14 hours had no significant effect on student mathematics and science achievement.

The total number of PD hours is only part of the story—depth of the substantive focus is also important. This substantive focus can occur in PD with relatively few hours if carefully designed, but PD with more hours increases the opportunity for deep content exploration (Cohen & Hill, 2000), thus increasing the likelihood of enhanced teacher content knowledge. Unfortunately, extended-duration content-specific PD is uncommon across our nation. Data from the 2007–2008 School and Staffing Survey indicated that only 24 percent of the nation's teachers participated in more than 33 hours of PD in the content they teach (Wei, Darling-Hammond, & Adamson, 2010).

Key Features of Effective PD

- *Substantial number of hours (~50)*
- *Intensive and follow-up experiences*
- *Facilitative of professional collaboration*
- *Science or mathematics content focused with active learning opportunities to transfer into teaching practices and curriculum*

The way PD hours are distributed across time is also important. Having a concentrated learning opportunity through either workshops or institutes (typically held during the summer), with follow-up sessions to reinforce the learning from the intensive experience, has been shown to be particularly supportive of teacher learning (Saxe, Gearheart, & Nasir, 2001). This kind of structure also provides an opportunity for professional networks to form among the participants and, if conducted within a school setting, can lead to the formation of communities of practice (Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009) that can undertake activities such as peer observations and coaching, and analysis of student work or assessment data to improve the curriculum and instructional practices in a given school.

Studies also show that the content of the PD program is related to student learning. In 1998, Kennedy found that subject-specific, content-based professional development that targets the curriculum as well as how students learn is more effective than focusing on general pedagogy, and further studies continue to corroborate this finding (Yoon et al., 2007). Further, professional development experiences should be structured to reflect how teachers learn. Opportunities for active learning or sense-making are important because they allow teachers to engage in transforming their practice rather than layering new strategies on top of the old (Wei et. al., 2009; U.S. Department of Education, 2011; National Staff Development Council, 2001).

Part 1: A Closer Look at the MSP Program Components

All of the aforementioned key features of effective PD programs were incorporated into the legislated allowable activities of the *No Child Left Behind Act* (Title II, Part B, Sections 2201-2203), which guides the MSP Program (http://www2.ed.gov/policy/elsec/leg/esea02/pg26.html). Exhibit 2 below displays these and other activities that states were allowed to fund through their requests for proposals.

Exhibit 2: MSP Allowable Activities in No Child Left Behind, Part B, Sec. 2202

Key Goals	No Child Left Behind "Allowable Activities"
Increasing science / math teacher content knowledge	Creating opportunities for enhanced and ongoing professional development of mathematics and science teachers that improves the subject matter knowledge of such teachers.
Promoting teaching skills	Promoting strong teaching skills for mathematics and science teachers and teacher educators, including integrating scientifically-based and technology-based teaching methods.
Conducting summer institutes and follow-up	Establishing and operating mathematics and science summer institutes or workshops, including follow-up training, for elementary and secondary school mathematics and science teachers. (A summer institute consists of at least 2 weeks of work. Follow-up should be at least 3 days.)
Recruiting math, engineering, science majors into teaching*	Recruiting mathematics, engineering, and science majors into teaching through the use of: (A) signing and performance incentives; (B) stipends for certification through alternative routes; (C) scholarships to pursue advanced course work in STEM; and (D) other programs that the State educational agency determines to be effective in recruiting and retaining individuals.
Developing curricula or aligning to state standards	Developing or redesigning more rigorous mathematics and science curricula that are aligned with challenging State and local academic content standards and with the standards expected for postsecondary study in mathematics and science.
Establishing distance learning	Establishing distance learning programs for math and science teachers using curricula that are innovative, content-based, and grounded in current scientifically-based research.
Peer mentoring by teachers	Designing programs to prepare a mathematics or science teacher at a school to provide professional development to other teachers at the school and to assist beginning and other teachers at the school, including mechanisms to integrate the teacher's experiences from a summer workshop or institute into the provision of professional development and assistance.
Exposure to STEM professionals	Establishing and operating programs to bring mathematics and science teachers into contact with working scientists, mathematicians, and engineers, to expand such teachers' subject matter knowledge of and research experience in science and mathematics.
K–8 science / math expertise-building*	Designing programs to identify and develop exemplary mathematics and science teachers in the kindergarten through grade 8 classrooms.
Encouraging underrepresented individuals into STEM*	Training mathematics and science teachers and developing programs to encourage young women and other underrepresented individuals in mathematics and science careers (including engineering and technology) to pursue postsecondary degrees in majors leading to such careers.

*A relatively small number of states (12, 11, and 7 respectively) mentioned these activities in their RFPs so they are not presented in this report.

For this report, a thorough review of each state's RFP, covering the time period of 2009–2010, was undertaken to determine the level of prominence that these PD activities were given nationally. Appendix A provides a snapshot of MSP projects by state, based on data from three sources: (a) the 2009–2010 state-issued request for proposal for each of the 50 states, DC and Puerto Rico[1]; (b) annual performance reports submitted during Performance Period 2009[2]; and (c) supplemental information from state MSP coordinators. A review of state RFPs, project annual reports, and information provided by state coordinators also reveals some interesting trends about the science and mathematics content covered in

1 For simplicity, throughout the remainder of the report the term "state" includes Washington DC and Puerto Rico.

2 Performance Period 2009 (PP09) includes projects where the majority of activities took place between October 1, 2009 and September 30, 2010, but some PP08 reports for which teacher and/or student data were not available in time to submit during the previous year were also included in PP09.

MSP projects and the professional development deployed through the MSP Program. An overview of these is provided below, and additional detail is contained in Appendix A.

Mathematics / Science Content and Teaching Skills

All states requested that projects increase teacher content knowledge in science and/or mathematics. Science and mathematics higher education faculty members are required to serve as PD providers for each MSP project. However, half of all states (52 percent)[3] additionally called for partnerships that would expose teachers to STEM professionals such as mathematicians and research scientists. The MSP Program's focus on increasing teachers' content knowledge through direct instruction by content experts is an effective strategy solidly backed by existing research.

Nationally, 44 percent[4] of states fund MSP projects that have similar emphases on science and mathematics content, 32 percent focus more on mathematics, and 24 percent focus more on science (see Appendix A). Exhibit 3 illustrates that, among the types of mathematics content being taught, problem-solving is the most common topic across grade levels. For projects serving elementary and middle school mathematics teachers, other common topics are number and operations and algebra. For projects serving high school mathematics teachers, the most common topics include algebra and technology use for mathematics instruction. For science-specific PD, scientific inquiry was taught by most projects, along with topics in physical and earth sciences, as well as technology use in science instruction (see Exhibit 4). Projects provide PD on multiple mathematics or science concepts, but most typically focus on those concepts that are part of the core state curriculum.

Exhibit 3: Percent of Projects Delivering Specific Mathematics Content by Grade Level

Mathematics Content	Projects Serving Elementary Teachers (N=301)	Projects Serving Middle School Teachers (N=312)	Projects Serving High School Teachers (N=238)
Problem-solving	87%	88%	84%
Number and operations	81	72	62
Algebra	65	79	84
Geometry	55	63	61
Measurement	59	58	48
Probability and statistics	45	53	56
Reasoning and proof	51	58	60
Calculus	2	7	18
Technology	56	65	74
Other	15	17	22

Source: Annual Performance Report item VI.A.2 for 2009. Total number of projects reporting in PP09 was 590.
The total number of projects that provided professional development in mathematics content areas or processes in PP09 was 406.
Percents total more than 100 because respondents could check more than one category. Projects could serve one or multiple school levels.

[3] 52 was used as the denominator for percentages related to data from state RFPs.

[4] 50 was used as the denominator for percentages related to active projects within a state in 2009–2010 because two states did not report during this period.

Exhibit 4: Percent of Projects Delivering Specific Science Content by Grade Level

Science Content	Projects Serving Elementary Teachers (N=261)	Projects Serving Middle School Teachers (N=275)	Projects Serving High School Teachers (N=193)
Scientific inquiry	95%	95%	92%
Physical science/Physics	68	75	73
Life science/Biology	59	57	56
Earth science	71	68	58
Chemistry	45	50	52
Technology	68	73	73
Other	26	29	28

Source: Annual Performance Report item VI.B.2
The total number of projects that provided professional development in science content areas or processes in PP09 was 354. The non-response rate was 0.
Percents total more than 100 percent because respondents could check more than one category. Projects could serve one or multiple school levels.

In 85 percent of the state RFPs, there was also an emphasis on providing PD on teaching skills that enhance student learning of science and mathematics content. **Most states (81 percent) emphasized** in their RFP that the **science and mathematics content covered in the PD needed to be aligned with the state educational standards**, and enhance teachers' ability to understand and use these standards. Professional development focused on substantive and research-supported teaching skills, as emphasized in the MSP Program, has been shown to be an effective strategy for improving both student and teacher learning.

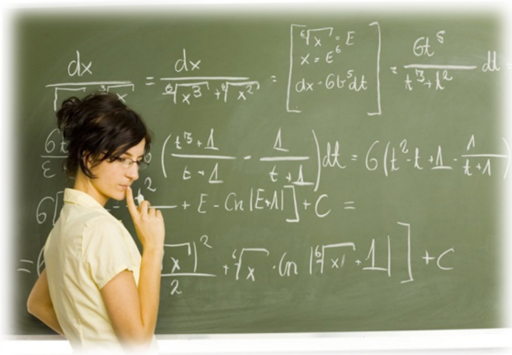
Across all active projects in the 2009–2010 reporting period, **nearly two-thirds of students of MSP teachers, scored at the *proficient* level or above** (64 percent of students in mathematics and 63 percent in science). This is an increase over prior reporting periods—in 2008, 58 percent in both mathematics and science; and in 2007, 45 percent in mathematics and 49 percent in science. Also in the 2009–2010 reporting period, **71 percent of the MSP teachers showed significant gains in science content knowledge and 62 percent in mathematics** on pre-post PD comparisons administered by the individual MSP projects.

Professional Development Delivery Formats

While the *Mathematics and Science Partnerships* enabling legislation provided guidance on allowable activities, it did not stipulate how these activities should be configured within projects to construct a cohesive professional development experience for teachers. As we will see in Part 2 of this report, some states provided further specifications for projects so that they fit into a state-wide reform effort, while many states allowed project partners to construct and implement their own coherent PD models. In this section we will describe the similarities and differences among states and projects in the ways PD content was delivered to teachers.

Summer Workshops / Institutes and School Year Follow-up

Nearly all states (43 states, 83 percent) requested that PD be delivered through summer institutes or workshops** (or an equivalent intensive experience) **with school-year follow-up. A majority of states (58 percent) also stipulated the required minimum number of PD hours. In the 2009 reporting period, the median number of PD hours delivered across projects ranged from 15 to 189 hours per participant (see Appendices A and B for more details). This meets, and often exceeds, the *recommended minimum* number of PD hours (14 to 49) that research has shown to increase student achievement in mathematics and science. It is also important to note that the range in hours reflects varying content knowledge and teaching skill goals of the states. For example, in Alabama (median=15 hours) the MSP projects are designed to support a specific and more limited amount of content whereas Texas (100 hours) has broad-reaching goals (see Part 2 for state profiles). Therefore the intensity of the experience for a teacher within any *particular* topic or skill area may be comparable in these two states even though the total number of PD hours varies greatly to cover more breadth of topics.



The PD activities varied from project to project; however, there were some common activities, including exploration of mathematics and science education content standards, curriculum mapping, lesson and curriculum development, classroom modeling and demonstration, classroom observation with feedback, and inquiry activities. The benefit of the summer intensive and school year follow-up PD format is that it is easier to establish a community of practice among the participants. Research supports activities that specifically encourage collaboration among teaching colleagues, but as we will see in the next section there are several ways to establish collaboration.

Train-the-Trainer Format

In 29 state RFPs (56 percent), there was a specific call for projects to prepare mathematics or science teachers to provide PD to other teachers at their school. The train-the-trainer PD format can be helpful in broadening the reach of the PD knowledge throughout a school system, and some MSP projects have found it useful.

Professional Learning Communities

Twenty-one percent of the 2009 projects reported having a professional learning community (PLC) as part of their PD experience.[5] At the most basic level a PLC consists of a group of participants (generally teachers) who meet over an extended period of time to focus on improving one or more aspects of teaching and learning. The PLC serves as a forum for teachers to share and reflect on their experiences and participate in generative discussion with their colleagues. Within these guidelines, PLCs take different forms, and vary in the number and types of participants, frequency of meetings, focus, and activities. Many PLCs within the MSP portfolio are comprised of teachers within one subject area. This arrangement allows for vertical alignment across grades within that subject, or for delving deeply into a particular content strand within a state standard. Some PLCs integrated teachers across subjects to gain an interdisciplinary approach to content or to address students that they teach in common. Still other projects reported that PLCs were district-wide, which yielded diverse participant perspectives. For example, one Indiana project established a district-wide PLC to support teacher leaders in creating school-level PLCs around mathematics teaching strategies. Involving teachers from different grade levels with varying experience levels allowed them to adapt activities to different grades, thus enhancing the vertical integration in the curriculum (Garrity, 2010).

In addition to content, PLCs addressed pedagogical issues pertaining to monitoring student thinking and designing more effective instruction. Commonly reported topics included strategies for inquiry-based learning, formative assessment, addressing student misconceptions, questioning, and scaffolding student understanding. The time dedicated to participating in the PLCs allowed teachers to delve deeply into instructional nuances that typically go unexamined. Participants had the opportunity to conduct peer observation of instruction, which is also not typically available. PLCs served as support networks where members could bring particular issues from their classrooms for discussion and problem-solving with the rest of the group.

One specific type of PLC, utilized in about 5 percent of MSP projects reporting in 2009, is ***lesson study***. Lesson study is a type of classroom practice-driven action research, in which a group of teachers co-research, plan, implement, reflect on, revise, and potentially re-implement a lesson. Though there were variations in how projects conducted their lesson study, most took a research-driven approach to collaborative lesson design. Lesson study allows teachers to delve deeply into the research, data collection and observation, reflection, and redesign of instruction.

[5] This was based on a text search of open-ended responses on APRs and may not include projects that either did not report on using a PLC in the open-ended responses or that used other terms to describe their PLCs.

One particularly unique and compelling aspect of lesson study is the use and evaluation of evidence of student learning from the lesson being studied. Often student work is used for this purpose and collectively teachers develop tangible, specific indicators of learning that should be present in student work. This concentrated focus on observable features of learning allows teachers in the group to discuss and make explicit their ideas on how they know learning has or has not occurred—beyond just a student providing a correct answer. For example, in one Ohio project, teachers used state content standards and district pacing guides to identify the research lesson's goals. With the help of university faculty as facilitators, teachers constructed learning hierarchies, explored instructional strategies such as Think-Pair-Share and Socratic questioning, and used project-developed protocols for pre- and post-lesson discussions on lesson effectiveness for student learning (Appova, 2011).

Online Learning Communities

The professional learning communities presented thus far primarily entail face-to-face interaction around shared instructional events. However, for many educators this is not an option due to scheduling constraints or remote location. Professional development in rural communities poses a unique set of challenges for MSP projects, such as limited resources stretched over vast areas, feelings of professional isolation, and difficulty accessing new technologies, research findings, or content experts. In these school settings, it is not uncommon for teachers to take on multiple roles at both school and district levels, making it a challenge for them to focus on any one responsibility (such as targeted professional development in STEM content).

Many rural MSP projects employed traveling PD providers and instructional coaches. In this way, a small group of experts could spread the PD benefits to a much larger and more disparate group of teachers. However for a number of projects this approach was not feasible, so instead they implemented creative uses of online and other communication technology to overcome barriers to professional development. While only 3 percent of projects identify online learning as their *primary* focus, many more (at least 34 percent) use this mechanism as an important part of their overall PD approach. In fact, 19 states (37 percent) explicitly recognized the importance of establishing distance learning opportunities in their proposal solicitations.

MSP projects use various kinds of technology to form and facilitate online teacher learning communities—videoconferencing, forums, discussion boards, blogging, chat rooms, and file sharing. These mechanisms allow participants to engage in productive conversations in spite of distance or scheduling constraints, and have the added benefit of archiving participants' ideas for later access. Specific software applications that support online communities such as Blackboard or WebCT are used by projects to encourage collaboration and communication among teachers and STEM experts. Teachers who would otherwise travel long distances to meet their counterparts or university faculty were able to form communities and/or mentoring relationships through the use of communication technologies.

Part 2: MSP Program Outcomes

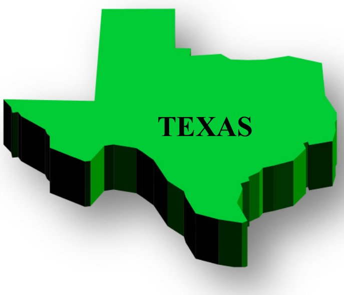
The MSP Program components, as established by the *No Child Left Behind Act*, are well-aligned with best practices for professional development that research has linked to student learning. Part 1 of this report provided examples of how states enacted these program components within the projects they funded, and some of the specific kinds of professional learning communities that have been enabled through the MSP Program. This section of the report will discuss the effects of the MSP Program in three areas:

- augmenting state-wide science and mathematics reform efforts;
- encouraging rigorous project evaluation designs to better understand the effect of PD interventions; and
- changing individual teachers' and students' science and mathematics knowledge and classroom experience.

By looking at program effects in these three areas, a more complete picture emerges of how the program has influenced changes at the state level, within the education evaluation community, and on individual learning.

MSP Program Augmenting State-wide Reform Efforts

Since the MSP Program disburses funds through formula grants, each state is responsible for determining how to use these funds to improve STEM education within the landscape of other state programs or initiatives, and for managing the projects given the existing state administrative structure. Each state handles these challenges in different ways. Here we highlight five states—**Texas, Alabama, Indiana, Massachusetts,** and **Arizona**—that provide different examples of integrating and leveraging formula grant funding into the larger landscape of state-wide reform efforts to improve STEM education. Texas, Alabama and Indiana had STEM PD initiatives and administrative structures to support these initiatives, independent of the MSP Program. Therefore, their challenge was to figure out how to use the MSP funds to fill in gaps within their state-wide reform efforts and coordinate various activities across initiatives to complement each other rather than create redundancy. Massachusetts has used MSP funds to shape an evolving strategic effort and Arizona has used them to establish a specific state-wide PD program (Intel Math). Below, state profiles provide additional details on how the MSP funds were used to further state-wide reform efforts. Though these strategies are unique to each state, they do provide examples for other states to consider in moving their STEM education efforts forward.[6]



In 1967 the Texas Legislature established Education Service Centers to help districts (1) improve student performance; (2) operate efficiently and effectively, and (3) carry out the mandates of the Texas Education Agency (TEA). These 20 Centers serve as liaisons between the TEA and school districts by disseminating information, conducting training, and providing consultation for federal and state programs. While the Centers assist the TEA in carrying out mandates, they remain

[6] The information for these profiles was provided by MSP state coordinators, and gathered from existing state Department of Education web documents.

independent and focus services on the needs of their school districts. Texas deliberately aims to coordinate all professional development to effectively leverage resources. The State Board of Education recently approved new Texas Essential Knowledge and Skills science standards and is revising the mathematics standards. The TEA has training to support the implementation of these standards, but the programs established with MSP funding—TX Statewide MSP Professional Development Network and T-STEM Centers—provide PD in areas not covered by the state training, thus creating a more comprehensive PD network.

TX Statewide MSP Professional Development Network—The University of Texas at Austin oversees this network, and uses the MSP funds to award Regional Collaboratives (approximately $150,000 each, depending on the number of teachers being served). Each Collaborative must have an institution of higher education and a high need school district as partners, and address the specific PD needs of the collaborative members.

The University of Texas provides train-the-trainer sessions for the collaboratives' Project Directors on a variety of content area topics. The Project Directors return to their collaboratives and train Mentor Teachers. Each collaborative has a required number of PD hours required for the Mentor Teachers (80–100 hours). After training, each Mentor Teacher must go back to their campus to train and mentor Cadre members. For many years, the collaboratives worked with individual teachers, but recently Texas has shifted to an immersion model where the collaboratives work with entire grade levels and/or campuses rather than individual teachers. For federal fiscal year 2010, there were 25 mathematics collaboratives and 39 science collaboratives supported.

T-STEM Centers and Secondary Mathematics Teacher Supports—The seven funded T-STEM Centers provide professional development to secondary schools across the state in specialized areas such as rocketry, robotics, and biotechnology. They assess the needs of the school, then design and deliver innovative training in conjunction with their partners. Unlike the more traditionally focused TX Statewide MSP Professional Development Networks, T-STEM Centers provide innovative professional development based on the instructional and economic needs of the area in which they serve (http://www.tea.state.tx.us; S. Avery, personal communication, October 31, 2011).

The Alabama Math, Science, and Technology Initiative (AMSTI) is the Alabama Department of Education's initiative to improve mathematics and science statewide by providing (1) Summer Institutes (wholly supported by MSP funding); (2) equipment and materials needed for effective mathematics and science instruction through Regional AMSTI sites where thousands of kits are stored, shipped, and restocked (materials kept by the teacher are purchased with state AMSTI funds, not MSP funding); and (3) mentoring in the classroom setting and follow-up with all participants.

The MSP funds also supplement AMSTI efforts by filling gaps in professional development that result from teacher mobility. MSP supports Compressed Training for teachers who had been formerly trained in the AMSTI program but changed grade levels within their school, and newly hired teachers in AMSTI schools who have not previously received training. By filling these gaps with MSP funds, and in a few instances state and local funds as well, math and science teachers in 46 percent of the schools in the state have been trained. MSP funds are also used to provide embedded coaching to high need schools by supporting 15 full-time mathematics and science specialist positions during the 2010–2011 funding period. The coaching and professional development supports provided by these personnel have helped schools to develop structures to sustain the lessons learned via Summer Institutes. As schools build capacity to support mathematics and science instruction, the need for specialist services diminishes (http://www.amsti.org; C. Jones, personal communication, October 14, 2011; Hollis & Howard, 2011).

Indiana has leveraged the business community to form a sustained effort to improve science and mathematics education throughout the state. The Indiana Science Initiative (ISI) (http://www.indianascience.org/) is a partnership between Eli Lilly and Company, the Indiana Department of Education, and the I-STEM Resource Network (https://www.istemnetwork.org/) working to reform K–8 science education. ISI started with the creation of Indiana's Strategic Plan for Science Education Reform in December 2008 by a committee of K–12 educators, scientists, government agents, and higher education faculty, led by the National Science Resources Center. The ISI is managed by the I-STEM Resource Network, a partnership of public and private higher education institutions, K–12 schools, business, and government in 10 regions throughout the state. I-STEM supports K–12 teachers and leaders in implementing high academic standards for STEM literacy for all students. I-STEM is able to offer MSP districts, and those Indiana districts that have elected to join the ISI, a reliable, stable source of research-based professional development and management of science materials. Districts and schools that want to participate in ISI collaborate with one of the regional I-STEM networks to develop partnerships eligible for MSP funding. Since the 2003–2004 school year, the Indiana Department of Education has supported over 20 school partnerships in developing innovative mathematics and science programs through the federal MSP Program (K. Linz Nelson, personal communication, October 28, 2011).

Massachusetts has used MSP funds to strategically expand the reach of professional development and bolster the rigor with which the impact of these efforts can be assessed. The MSP Program has allowed the state to regionalize and scale up several successful professional development models such as the 80–hour Massachusetts Intel Math Initiative (MIMI) (http://www.doe.mass.edu/omste/news07/mimi.html) course and professional learning community follow-up. The original MIMI model was a partnership between district mathematics leadership and higher education professors, and was expanded by the Mathematics Improvement Project to include three institutions of higher education and over 28 districts in the Cape Cod and North River Collaboratives. Teachers in all of Southeastern Massachusetts were afforded the opportunity to participate in high quality mathematics professional development; 260 teachers completed the MIMI course and follow-up during the grant period. This model can be used to regionalize other professional development programs.

The Race to the Top grant issued via the *American Recovery and Reinvestment Act of 2009* has allowed for the expansion of model courses developed in MSP partnerships by scaling up mathematics PD offerings in six regional targeted support centers across the state. Teachers in the highest need districts now have the opportunity for quality PD developed by MSP, wherever in the state they live and work.

The expansion of PD has also taken place at the university level. Eleven of the courses developed by partnerships during 2009–2010 have been approved as offerings by institutions of higher education. Two of the MSP-created courses are now available online for pre-service teachers. Others have been approved and continue to be offered to educators across Massachusetts for graduate credit through the state universities. Cumulatively, three degree programs in math and science have been developed and are currently offered to educators as a result of the MSP Program.

The MSP Program has also provided the impetus for improving the tools used to assess the effects of PD programs in the state. The Professional Development Observation Tool that was developed under MSP funding is currently used in Massachusetts, not only for MSP project courses, but also for most other summer institutes and workshops. MSP funds have allowed Massachusetts to improve its measures of PD quality. The MSP Program challenged the state's ability to collect student achievement data linked to teachers, in order to investigate student outcomes of teachers receiving PD courses. As a result, the state's data warehouse was redesigned to provide a framework that allows the state to select and aggregate student data linked directly to specific teachers, thus allowing for a more robust assessment of the impact of the PD interventions.

Lastly, the MSP funds have contributed to better alignment of the U.S. Department of Education and Massachusetts State STEM Plan goals. The Governor's STEM Advisory Council, which represents all key stakeholders in the state, has developed the first ever state-level STEM plan. This plan has been recognized by the National Governor's Association as a model for other states. The five goals of this plan are supported by the Race to the Top grant, state, and other federal funds. MSP supports goal five: to increase the percentage of STEM classes led by effective educators from Pre-K to 12. The MSP funds represent a significant source of targeted funding for STEM professional development provided to districts. Since the program's inception in 2004, MSP has reached 2,673 teachers and filled 5,172 seats in 298 available courses (http://www.doe.mass.edu/omste/grants.html; C. Lach, personal communication, October 28, 2011).

Arizona has used MSP funds to adopt and disseminate a specific professional development model, Intel Math, throughout the state because K–8 mathematics scores on the state assessment showed a real need for improvement. In the most recent request for proposals, it was specified that projects must include a minimum of 104 contact hours during the life of a project. The Intel Math training provides a one-week summer workshop and 7 PD days during the school year, for a total of 12 days of training. Intel Math is grounded in a problem-solving approach to topics such as integer arithmetic, the decimal number system, place value, rational number arithmetic, rates, linear equations, and functions. Connections are made throughout the course as multiple representations of solutions are examined with each problem. Pedagogy comprises approximately 10 percent of the course content and classroom transfer is addressed primarily through opportunities to analyze student work and instructor modeling. By restricting the type of professional development model that can be supported with MSP funds, Arizona is making targeted improvements in the professional development of its teachers (http://www.azed.gov/standards-practices/msp/; S. Mast, personal communication, November 21, 2011).

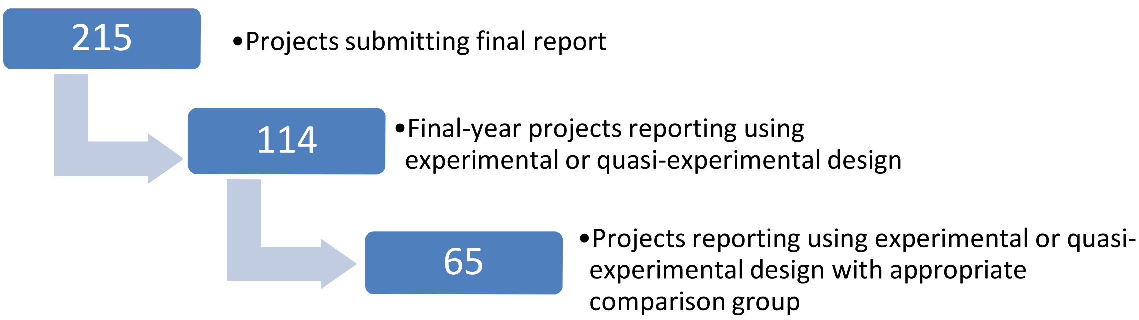
MSP Program Encouraging Rigorous Project Evaluation Designs

Every MSP project is required to design and implement an evaluation and accountability plan that allows for an assessment of its effectiveness. Projects are required to report annually to the U.S. Department of Education on two aspects of their evaluation findings: 1) gains in teacher content knowledge based on pre- and post-testing; and 2) proficiency levels on state-level assessments of students of teachers who received professional development. In addition, 21 states (40 percent) require participation in a statewide MSP Program evaluation that would gather data beyond the annual reporting requirement (see Appendix A) to determine the cumulative state impact of the MSP Program.

Through their RFPs, states have the opportunity to place stipulations on the kinds of designs and instruments that projects are eligible to use for their individual project evaluations. Slightly more than half of the states (55 percent)[7] specifically stated that either experimental[8] or quasi-experimental designs were required (3 states) or preferred (25 states). The remaining 23 states (45 percent) did not specify an evaluation design preference (see Appendix A). Across all funded projects for the last reporting period, approximately half (51 percent) reported using an experimental or quasi-experimental design. This is on a par with the 2008 reporting period, in which 52 percent of the projects reported using a comparison group design, and shows an increase from 2007 when it was 44 percent of projects.

As part of the portfolio review, Abt Associates conducted a review of final-year MSP projects that reported using an experimental or quasi-experimental comparison-group design to evaluate their MSP projects. The goal of the review was to determine which projects successfully conducted rigorous evaluations yielding findings that could be considered reliable and valid. To this end, Abt Associates conducted detailed reviews of projects' evaluations to assess whether they met criteria established for rigorous evaluations of interventions.[9] Of the 215 final-year projects, 65 were eligible to have their evaluation designs and findings reviewed for rigor. Exhibit 5 below depicts the process by which eligibility for assessing program effects was determined.

Exhibit 5: MSP Projects Selected for Review of Evaluation Rigor



Within each project, the evaluation design to determine the impact of an outcome—teacher content knowledge, classroom practice, or student achievement—was reviewed separately for methodological rigor. Of the 65 final-year MSP projects reviewed for 2009, 16 projects (25 percent) successfully

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[7] Colorado's RFP was only for existing projects, so the denominator for this section is 51 rather than 52 states.

[8] Experimental design—participants assigned at random to MSP and non-MSP professional development experience; Quasi-experimental design—matched comparison groups

[9] More information on the review and criteria is available in the full Annual Report (Bobronnikov, Donoghue, Fried, & Mendez, 2011).

implemented rigorous evaluation designs to determine the impacts of their programs beyond what was captured in the annual reporting statistics (see Appendix C for descriptions). This represents a five-fold increase from the previous year. Since half of projects (51 percent) in 2009 reported using an experimental or quasi-experimental design in their evaluation of ongoing projects, it is anticipated that in future years there will continue to be an increase in the number of completed projects that generate impact findings via rigorous evaluation designs.

With regard to outcomes of interest, we found that the evaluation design and instrumentation to measure the effect of PD on teacher practice is in most need of improvement. In the review of projects, 9 of the 13 studies that assessed this outcome were determined to be of low methodological rigor. The lack of reliable and validated instruments for assessing the effect of an intervention on teaching practice is not an issue specific to the MSP Program, but is rather a pervasive problem in the field of STEM research and evaluation.

Trends in Teacher and Student Learning

Earlier, this report noted that, based on required annual reporting information, 62 percent of participating teachers showed significant gains in mathematics content knowledge and 71 percent showed significant gains in science on pre-post professional development comparisons of content knowledge. Additionally, the students of these teachers showed substantial increases in their science and mathematics proficiency—nearly two-thirds scored at the *proficient* level or above (64 percent of students in mathematics and 63 percent in science).

In looking at the 16 projects whose evaluations passed the rigor review, 5 found significant gains in teacher content knowledge, 2 found significant changes in practice, and 5 found significant gains in student content knowledge. We identify below some of the specific findings within the PD projects focusing on science, math, and math and science combined.

Six projects offered professional development focused on science content for elementary or middle school teachers, and three presented evidence of effects—two on teacher content knowledge and one on student achievement.

- One of the studies showed that participating teachers’ knowledge of earth and space science increased 3.25-fold over that of a comparison group of non-participating teachers.
- Another study demonstrated a significant gain in participating teachers’ knowledge about matter and about motion and forces, whereas the non-participating teachers showed an overall decrease in their knowledge of physical science.
- The third study demonstrating effects of science-focused professional development showed that students of the teachers who had participated in the MSP summer institute and follow-up sessions improved significantly in their understanding of physical science, mathematics and engineering. This improvement was more than that shown by students of non-participating teachers. Additionally, the more professional development activities a teacher performed, the higher the students’ post-test scores.

Seven projects offered professional development to elementary or middle school mathematics teachers. Three of these studies identified significant impacts of the program on student mathematics achievement scores on state assessments, and three studies were not able to identify a significant impact. An additional study showed that 94 percent of participating teachers increased their mathematical knowledge related to numbers, algebra, and geometry an average of six times more than the non-participating teachers. A significant impact on classroom practice was also identified in this study, with 86 percent of the treatment teachers compared to 60 percent of the control teachers showing a change in their practice. The teachers who participated in the professional development made substantial improvement in the student/teacher relationship as a result of the professional development experience.

Among the three projects that offered professional development in a combination of topics (e.g., mathematics, science, and engineering), two demonstrated effects on teacher science content knowledge, and one on teacher mathematics and engineering content knowledge. Increased student achievement in mathematics and science content for students whose teachers participated in the professional development experience was demonstrated in one of the projects and not in the others.

In comparing the distribution of findings, we see a clearer trend for the positive effect of these MSP project interventions on teacher science/mathematics knowledge than on practice or student achievement within this set of 16 projects that conducted rigorous evaluations. Since the main goal of the MSP Program is to increase teacher content knowledge, this trend is encouraging. As noted above, many other projects identified positive effects of their professional development on teachers and students, and the 16 projects described in this section just represent the subset of projects that measured impacts in a rigorous way.

Summary of Sucesses

Partnerships Between Local Education Agencies and Faculty at Institutions of Higher Education Have Been Established in All 50 States, Puerto Rico, and Washington DC.

These partnerships provide science and mathematics professional development to teachers to increase their content knowledge. Forty-four percent of states fund a balanced portfolio of projects with relatively equal emphasis on science and mathematics content. Nearly one-third of states have more PD opportunities focused on mathematics, and 24 percent focus more on science. Most states explicitly require that the content covered in the PD be aligned with state educational standards, and that PD be provided on teaching skills that research has shown to enhance student learning of science and mathematics content.

Large Majorities of Teachers Show Significant Gains in Science and Mathematics Content Knowledge.

Across all active projects in the last annual reporting period (2009–2010), the majority of MSP participating teachers showed significant gains in content knowledge—62 percent in mathematics and 71 percent in science. These gains in mathematics were found in 82 percent of states reporting, and in science, 85 percent of states reporting—representing widespread improvement in the science and mathematics knowledge of our nation's K–12 teachers.

Teacher Content Knowledge Built through a Range of Professional Development Strategies.

The most common strategy for delivering professional development was that which was recommended by the legislation—summer institutes with school-year follow-up. Another strategy, used to reach more teachers within a district, was the train-the-trainer approach. In 29 state RFPs, there was a specific call for projects to prepare mathematics or science teachers to provide PD to other teachers at their school. Most of these states had some remote, substantially rural districts that would benefit from local PD capacity-building because external support is often limited. Another commonly used strategy to develop local capacity was the establishment of a professional learning community, either through intensive in-person interactions among teachers or via online learning communities (especially for remote locales).

Students Become More Proficient in Science and Mathematics.

In the 2009–2010 reporting period, nearly two-thirds of the students of MSP teachers scored at or above the proficient level on state assessments (64 percent of students in mathematics and 63 percent in science), compared to fewer than half in the previous reporting period.

MSP Funding Augments State-Wide Efforts to Produce More Systemic Reform.

States are integrating and leveraging MSP funding into the larger landscape of state-wide reform efforts to improve STEM education. Some states had existing state-level STEM PD initiatives that pre-dated the NCLB legislation. Therefore, they are using MSP funds to fill in gaps within their state-wide reform efforts. Other states are using MSP dollars to establish a specific state-wide PD program that would provide a common educational experience across all districts in the state, in areas that assessments have shown to be particularly weak for students. In some states, MSP funds are used as the sole source of funding for mathematics and/or science PD.

MSP Encourages Rigorous State-Level Program Evaluation.

Through request for proposals, states have the opportunity to place stipulations on the kinds of designs and instruments that projects are eligible to use for their individual project evaluations. Slightly more than half of the states specifically stated that either experimental or quasi-experimental designs were required or preferred. Across all funded projects for the last reporting period, approximately half reported using an experimental or quasi-experimental design. This is on a par with the 2008 reporting period, but shows an increase from 2007. While there remains substantial room for improvement in implementing these rigorous designs, there has been a substantial increase in the percentage of projects generating reliable and valid findings over the past two reporting periods.

MSP Is Aligned with Research on Effective Professional Development.

Research has identified four key features of effective PD:

- Substantial number of hours (~50)
- Intensive and follow-up experiences
- Facilitative of professional collaboration
- Science or mathematics content focused with active learning opportunities to transfer into teaching practices and curriculum

This report has shown that the MSP Program has supported the implementation of these key features across the projects funded, while allowing for a range of approaches to meet identified needs within each state.

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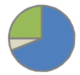
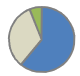
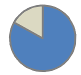
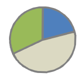
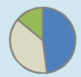
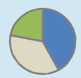
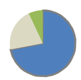
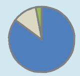
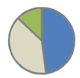
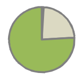
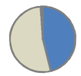
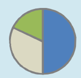
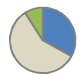
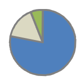
Appendix A: Snapshot of Mathematics and Science Partnerships Programs by State

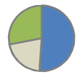
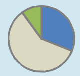
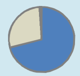
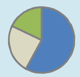
STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2] Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals	Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities)[2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at **Elementary** **Middle** **High**	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
AL **11**	●	●		❍		●	❍	RCT/QED preferred	YES	Expand the reach of an existing state PD system (AMSTI). Provide teachers with hands-on, activity-based instruction. Focus on sustainability of PD. (low)	15 (4–36)		Math & science=100	Moderate
AK **0**	●	●	●	●				RCT/QED preferred	NO	K–8 Math only. (moderate)	120	No Annual Performance Reports were submitted. Although there were ongoing MSP activities, the timing of the APR submission did not coincide with the performance period included in this report.		
AZ **12**	●	●	●	●		●		RCT/QED preferred	YES	K–8 Intel Math Program as part of the summer intensive session. (high)	105 (104–123)		Math=50 Science=50	Moderate
AR **21**	●	●		●			❍	Unspecified	NO	(low)	78 (60–132)		Math=40 Science=50 Both=10	Smaller
CA **41**	●	●	●	●	❍	❍		QED required	YES	Math: grade 3 through algebra 1 OR Science: grade 3 through 8. (moderate)	92 (60–123)		Math=70 Science=30	Moderate
CO **11**	●							Not required in this grant-extension RFP	NO	Only current grantees could apply to expand program to focus on not highly qualified teachers and science and math special educators. (high)	78 (28–180)		Math=35 Science=35 Both=30	Smaller-moderate

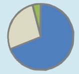
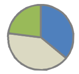
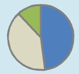
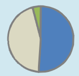
[1]information obtained from Performance Period 2009 Annual Performance Reports (APR) (activities primarily occurred during September 2009 – October 2010)
[2]Information obtained from each state's RFP. ("Priorities" are defined in Exhibit 2. ● = a stated main priority; ❍ = stated as a secondary priority; no bullet = not an explicitly stated priority)
[3]See Appendix B for additional information.
[4] RCT- Randomized Control Trial (participants assigned at random to MSP and non-MSP professional development experience); QED-Quasi-experimental Design (matched comparison groups)
[5]low=RFP provides general statements about the PD model to be used; does not require specific PD components; has to align to state content standards, but doesn't constrain the PD to any particular grade or concepts
moderate=RFP provides a couple of options of different PD models that can be used; specifies types of PD components that must be incorporated into any PD program; specifies a grade-level or content focus
high=RFP specifies the PD model to be used, the components of the PD program, and science/math content/curricula to be covered in PD
[6]smaller=funded up to \$200,000/project; moderate= \$200,001 to \$500,000; larger=more than \$500,000 (if two categories are noted then there is an even number of projects in each category)

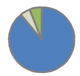
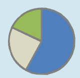
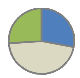
STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2] Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals	Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at Elementary Middle High	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
CT **3**	●	●	●	●		●		QED preferred	YES	K–8 focus: Instructional Coaching Academies including graduate content courses and Cognitive Coaching Training. (moderate)	66 (60–93)		Math=70 Both=30	Moderate
DE **4**	●	●		●	❍	●		RCT preferred	YES	(low)	41 (36–100)		Math=100	Smaller-moderate
DC **2**	●	●		❍	❍	❍	❍	Unspecified	NO	Grades 6–12 focus: math (algebra, geometry, probability & statistics) or science. (low)	189 (162–215)		Math=50 Both=50	Moderate
FL **1**	●				●	●		Unspecified	NO	Emphasis on training to teach ELL and African-American students challenging science. PD must support development of school-based Lesson Study Teams. (moderate)	80 (all 80)		Both=100	Larger
GA **25**	●	●	●					QED preferred	YES	School-based teacher cohort training approach. (low)	80 (74–184)		Math=35 Science=10 Both=55	Smaller-moderate
HI **5**	●	●	●					Unspecified	YES	School-based teacher cohort training approach. Provide instruction on the use of assessment data to inform practice. (low)	64 (30–90)		Math=40 Science=20 Both=40	Smaller-moderate
ID **4**	●	●	●	●		●	●	QED preferred	NO	Grades 5–12 focus. (low)	65 (58–100)		Math=25 Science=50 Both=25	Smaller-moderate

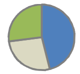
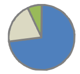
STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2]							Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at Elementary Middle High	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
	Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals							
IL **38**	●	●	●	●	❍	●		Unspecified	YES	Graduate program leading to a master's degree for science and math teachers in high-need LEAs, who then serve as school leaders to train others; OR 28 2-week summer workshops providing specified professional development. (low)	135 (80–450)		Math=15 Science=25 Both=60	Small-moderate
IN **20**	●	●	●	●	❍	❍	❍	RCT/QED preferred	NO	Focus: algebra readiness gr. 4–8; pre-and advanced placement math gr. 6–12; science readiness/inquiry-based instruction gr. 3–8 or 6–12. 66% of teachers must participate in vertical team within a focus area. (moderate)	90 (24–201)		Math=50 Science=40 Both=10	Smaller
IA **5**	●	●	●			●	●	Unspecified	NO	Inclusion of administrators in planning the PD. (moderate)	100 (40–140)		Math=60 Science=40	Smaller-moderate
KS **8**	●		●	●			●	Unspecified	NO	Math focus. (moderate)	94 (70–131)		Math=90 Both=10	Smaller
KY **22**	●	●	●	●	❍	❍	❍	RCT/QED preferred	YES	(low)	78 (28–180)		Math=50 Science=30 Both=20	Smaller
LA **26**	●	●	●	●			●	QED preferred	YES	Focus: Grades 3 & 4 math and science content. High School projects: Algebra I and Physical Science. (high)	121 (120–162)		Both=100	Smaller
ME **12**	●	●	❍	❍	❍	●	●	Unspecified	NO	Competition was limited to existing partnerships funded previously—with a focus on scale-up across the state. Improve use of data to inform practice. (low)	34 (17–63)		Math=20 Science=30 Both=50	Smaller

STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2] Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals	Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at Elementary Middle High	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
MD **4**	●		●			●		QED preferred	NO	Grades 4–8 focus. Includes ELL and special education teachers. (low)	77 (62–100)		Math=50 Science=50	Moderate
MA **8**	●	●	●					RCT/QED preferred	NO	Grades 5–8 focus. Sustained course of study for in-service teachers of STEM by integrating the courses of study into institutions of higher education. (moderate)	65 (61–150)		Math=50 Science=40 Both=10	Moderate
MI **10**	●	●	❍		❍			Unspecified	YES	Math focus Provide support for Math/Science Centers: Algebra for All initiative OR Michigan Math & Science Teacher Leader Specialist program. (moderate)	49 (21–120)		Math=70 Science=10 Both=20	Moderate -larger
MN **10**	●		●	●		●		Unspecified	NO	Grades 6–8 algebra focus. At least 75% of teachers from each school who deliver math instruction in grades 6–8 must commit to participation throughout the duration of the instructional module. (moderate)	43 (25–100)		Math=70 Both=30	Smaller
MS **5**	●	●	●	●			●	Unspecified	NO	Grades 7 & 8 focus. (high)	127 (96–175)		Math=40 Science=40 Both=20	Larger
MO **8**	●	●	●	●		●	●	RCT/QED preferred	NO	Grades 6–12 math and grades K–6 science focus. (moderate)	113 (78–134)		Math=60 Science=15 Both=25	Moderate
MT **8**	●	●		●				RCT/QED preferred	NO	Bring district administrators together with teachers to develop more rigorous math and science curricula (low)	65 (32–130)		math=30 science=60 both=10	Smaller

STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2] Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals	Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at Elementary Middle High	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
NE **2**	●	●	●	●	❍	●		Unspecified	YES	Establish a statewide community of learners. (moderate)	84 (all 84)		Math=50 Science=50	Larger
NV **4**	●	●	●	●	●	●	●	RCT/QED preferred	NO	(low)	92 (60–124)		Science=30 Both=70	Smaller
NH **13**	●	●	●	●				Unspecified	NO	(moderate)	45 (20–120)		Math=30 Science=45 Both=25	Smaller
NJ **6**	●	●	●	●	❍	❍	❍	RCT preferred	NO	Establishing Professional Learning Communities including a cross-grade teacher exchange program. (moderate)	106 (62–155)		Both=100	Larger
NM **3**	●	●	●	●			●	Unspecified	NO	Grade 5–12 math focus. (high)	58 (10–82)		Math=100	Moderate -larger
NY **18**	●	●	●	●	❍	❍	❍	RCT/QED preferred	NO	Also have an interdisciplinary STEM focus as a separate Competitive Priority category of funding from science and math. (low)	65 (41–156)		Math=35 Science=45 Both=20	Larger
NC **18**	●	●	●	●				RCT preferred	NO	(low)	45 (16–168)		Math=60 Science=20 Both=20	Moderate

STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2]							Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at Elementary Middle High	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
	Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals							
ND **3**	●	●	●	●			●	Unspecified	NO	(low)	125 (110–132)		Math=33 Science=33 Both=33	Moderate
OH **14**	●		●	●				Unspecified	YES	Target school model where all science and math teachers must participate. (moderate)	91 (40–300)		Math=35 Science=30 Both=35	Smaller-moderate
OK **10**	●	●	●	●	○	●	●	Unspecified	NO	(moderate)	95 (74–200)		Math=20 Science=10 Both=70	Smaller-moderate
OR **7**	●	●	●	○	○	○	○	RCT/QED preferred	YES	(low)	76 (30–200)		Math=15 Science=70 Both=15	Moderate
PA **6**	●		●	●				RCT/QED required	YES	(low)	88 (49–108)		Science=50 Both=50	Larger
PR **14**	●	●	●	●		●	●	RCT/QED preferred	NO	(moderate)	182 (128–265)		Math=5 Science=5 Both=90	Larger
RI **3**	●	○		●				Unspecified	YES	Formation of leadership teams to do curriculum alignment within their system. (low)	49 (40–50)		Math=50 Science=50	Moderate

STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2] Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals	Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities) [2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at **Elementary** **Middle** **High**	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
SC **0**	●	●	❍	●	❍	●	❍	Unspecified	NO	(low)	No Annual Performance Reports were submitted. Although there were ongoing MSP activities, the timing of the APR submission did not coincide with the performance period included in this report.			
SD **7**	●	●	●			●		RCT/QED preferred	YES	Grades K–6 math focus. Developing math coaches and teacher-leaders is a focus. Developing confidence and competence in mathematics for K–6 teachers. (moderate)	90 (70–90)		Math=100	Smaller
TN **9**	●	●	❍	●			●	Unspecified	NO	(low)	81 (51–150)		Math=45 Science=35 Both=20	Moderate
TX **69**	●	●	●	●		●	●	RCT/QED preferred	YES	MSP dollars are spread across 2 different state programs (TxMSP and T-STEM Centers). (moderate)	100 (24–646)		Math=35 Science=50 Both=15	Smaller
UT **10**	●	●	●	●	●	❍	❍	Unspecified	NO	(low)	96 (29–270)		Math=20 Science=60 Both=20	Smaller
VT **6**	●	●	●			●	●	RCT/QED preferred	NO	Formation of Teacher Learning Communities especially on formative assessments. (moderate)	84 (61–175)		Math=30 Science=70	Smaller-moderate
VA **11**	●			●	❍			RCT/QED preferred	YES	Math focus. Development of Math PD Centers. (moderate)	75 (40–180)		Math=55 Science=45	Moderate

STATE Number of active projects[1]	State Request For Proposals (2009–2010) Priorities[2]							Project Evaluation Design Requirements[2,4]	Participation in Statewide MSP Program Evaluation Required in addition to APR Reporting[2]	Unique Aspects[2] (level of state-prescriptiveness for PD activities)[2,5]	Hours of PD/year[1]: median (range)[3]	Percent of participating educators[1,3] at **Elementary** **Middle** **High**	Percent of projects by content focus[1]	Funding category most projects fall within[1,6]
	Increasing STEM teacher content knowledge	Promoting teaching skills	Summer institute and follow-up	Developing curricula or aligning to State standards	Distance learning	Peer mentoring by teachers	Exposure to STEM professionals							
WA **14**	●	●	●	●				Unspecified	YES	(low)	60 (12–88)		Math=30 Science=35 Both=35	Moderate
WV **5**	●	●	●	●	❍	❍	●	QED preferred	YES	Grades 7–12 math focus. Incorporating Action Research. (high)	110 (82–132)		Math=40 Both=60	Smaller
WI **9**	●	●	●	●			●	RCT/QED required	NO	(low)	100 (75–112)		Math=80 Science=10 Both=10	Moderate
WY **5**	●	●	●	●				Unspecified	NO	(low)	88 (83–110)		Math=20 Science=60 Both=20	Smaller-moderate
TOTAL STATES PER ACTIVITY	● 52 ❍ 0 52 100%	● 43 ❍ 1 44 85%	● 39 ❍ 4 43 83%	● 38 ❍ 4 42 81%	● 3 ❍ 16 19 37%	● 20 ❍ 9 29 56%	● 17 ❍ 10 27 52%							

Appendix B: Details on Professional Development (PD) and Participating Educators (Performance Period 2009)

State	Number of Projects by PD Hours				Number of Participants Receiving PD	Percent of Participating Educators by Grade Level		
	≤ 60	61 - 90	91 - 120	≤ 121		Elementary school	Middle school	High school
AL	11	-	-	-	4,006	75%	18%	7%
AZ	-	-	10	2	435	69	6	25
AR	1	18	1	1	647	32	35	33
CA	2	17	20	1	2,142	61	33	6
CO	5	-	3	2	610	38	51	11
CT	1	1	1	-	77	83	17	0
DE	3	-	1	-	452	18	56	26
DC	-	-	-	2	40	21	47	32
FL	-	1	-	-	1,214	48	38	14
GA	-	19	5	1	1,614	36	33	31
HI	2	3	-	-	217	42	36	22
ID	2	1	1	-	153	72	21	7
IL	-	8	10	19	948	27	34	39
IN	1	9	6	3	1,507	66	21	13
IA	2	-	2	1	542	87	7	6
KS	-	3	3	1	278	85	12	3
KY	5	12	3	2	1,069	48	39	13
LA	-	-	12	13	742	78	4	18
ME	10	1	-	-	188	1	23	76
MD	-	3	1	-	329	46	53	1
MA	-	5	1	2	660	37	47	16
MI	8	1	1	-	1,874	13	31	56
MN	8	1	1	-	660	50	32	18
MS	-	-	2	2	432	33	58	9
MO	-	1	5	2	437	21	33	46
MT	4	2	1	1	220	78	16	6
NE	-	2	-	-	657	51	21	28
NV	1	-	-	1	114	31	59	10
NH	9	2	2	-	419	41	24	35
NJ	-	1	3	2	240	71	28	1
NM	2	1	-	-	532	14	71	15
NY	6	9	1	1	4,518	58	24	18
NC	12	3	1	1	2,727	68	18	14
ND	-	-	1	2	152	13	16	71
OH	2	5	5	2	1,607	69	27	4
OK	-	4	5	1	462	36	41	23
OR	2	2	1	2	399	48	40	12
PA	1	3	2	-	448	59	29	12
PR	-	-	-	14	1,434	51	45	4
RI	3	-	-	-	660	68	14	18
SD	-	7	-	-	255	94	6	0
TN	1	5	2	1	414	39	31	30
TX	6	19	24	13	6,296	25	19	56
UT	2	2	3	2	1,905	89	5	6
VT	-	4	1	1	384	58	24	18
VA	4	3	2	2	1,290	28	46	26
WA	7	6	-	-	1,673	46	27	27
WV	-	2	2	1	137	4	51	45
WI	-	1	8	-	567	73	20	7
WY	-	3	1	-	167	67	15	18

NA=math/science was not part of the MSP portfolio of projects for this year. NR=insufficient APR data submitted. 0%=no participants had significant gains.

Appendix C: Completed MSP Projects with Rigorous Evaluation Designs

MSP Project	State	Participants	Content Area	Professional Development	Design of Passing Evaluation(s)	Evaluations with Positive Findings
Project Teacher Improvement through Mathematics Instruction (T.I.M.E.)	AZ	66 K–3rd grade teachers	Math	Summer institute plus three weekend workshops during the school year	QED (2)	Teacher content knowledge Classroom practice
Yavapai County Math and Science Partnership – MSP2 Science	AZ	23 K–5th grade teachers	Science	Four-day summer workshop plus school-year weekend workshops	QED	Teacher content knowledge
Conceptual Understanding of Biological Science (CUBS2)	AZ	26 K–8 teachers	Science	Six school-year weekend workshops followed by a five-day summer workshop	QED	None
South Bay Mathematics Collaborative	CA	114 5th–7th grade teachers	Math	30-hour summer workshop plus 30 hours of workshop sessions, 24 hours of classroom coaching	QED	None
Carpinteria and Santa Barbara School – Community Science Initiative	CA	43 4th–6th grade teachers	Science	40-hour summer workshop plus 20-24 hours of follow up sessions and lesson study activities	QED	None
Achievement in Little Lake for Mathematics (ALL for Math)	CA	60 elementary and middle teachers	Math	At least one 10-week content course at IHE, plus district mini-courses	QED	None
Sacramento Algebra Collaborative	CA	14 5th–8th grade teachers	Math	Summer institute followed by 6 hours of school year coaching and 18 hours of lesson study.	QED	Student achievement
Eastern Shore Math Consortium (ESMC) IV	MD	25 4th–8th grade teachers	Math	5-day summer workshop preceded and followed by workshops. Online discussion board and mentoring.	QED	None
Creating High Achievement in Mathematics and Problem Solving (CHAMPS) Year 3	MS	150 5th–8th grade teachers	Math	Summer institute followed by four Saturday mini-conferences, plus mentoring, classroom visits, and an online community/resource center.	RCT	Student achievement
Partnership to Improve Student Achievement through Real World Learning in Engineering, Science, Mathematics, and Technology	NJ	46 elementary teachers	Science	Summer institute plus school-year follow-up including 2 workshops, an online session, monthly classroom visits, and a 3-day institute.	QED	Student achievement
Establishing Excellence in Education for Mathematics and Science (ESTEEMS) II	NJ	43 3rd–5th grade teachers	Math & Science	Summer institute plus 2–3 follow-up days during the school year and mentoring	QED (2)	Student achievement Teacher content knowledge
Allegheny Intermediate Unit MSP of Southwestern PA	PA	136 K–12th grade teachers; 9 admins	Math & Science	Summer & school year academies, lab experiences, and content courses	QED	None
Tennessee Pre-Engineering Math Science Research Partnership	TN	57 7th–12th grade teachers	Engineering	Summer institute plus two follow-up Saturday workshops per semester	RCT	Teacher content knowledge
Upper Cumberland Middle Grades Science Research Partnership	TN	40 5th–8th grade science teachers	Science	Summer institute plus two follow-up days and a graduate-level course	RCT	Teacher content knowledge
Rice Regional Science Collaborative	TX	72 3rd–5th grade teachers	Science	Weekly training, student and peer observation, 4 annual campus support visits	QED	None
Understanding the World through the Language of Math: Math Literacy for All	WI	200 elementary teachers	Math	6 school-year days plus a capstone Summer Institute	RCT	Student achievement